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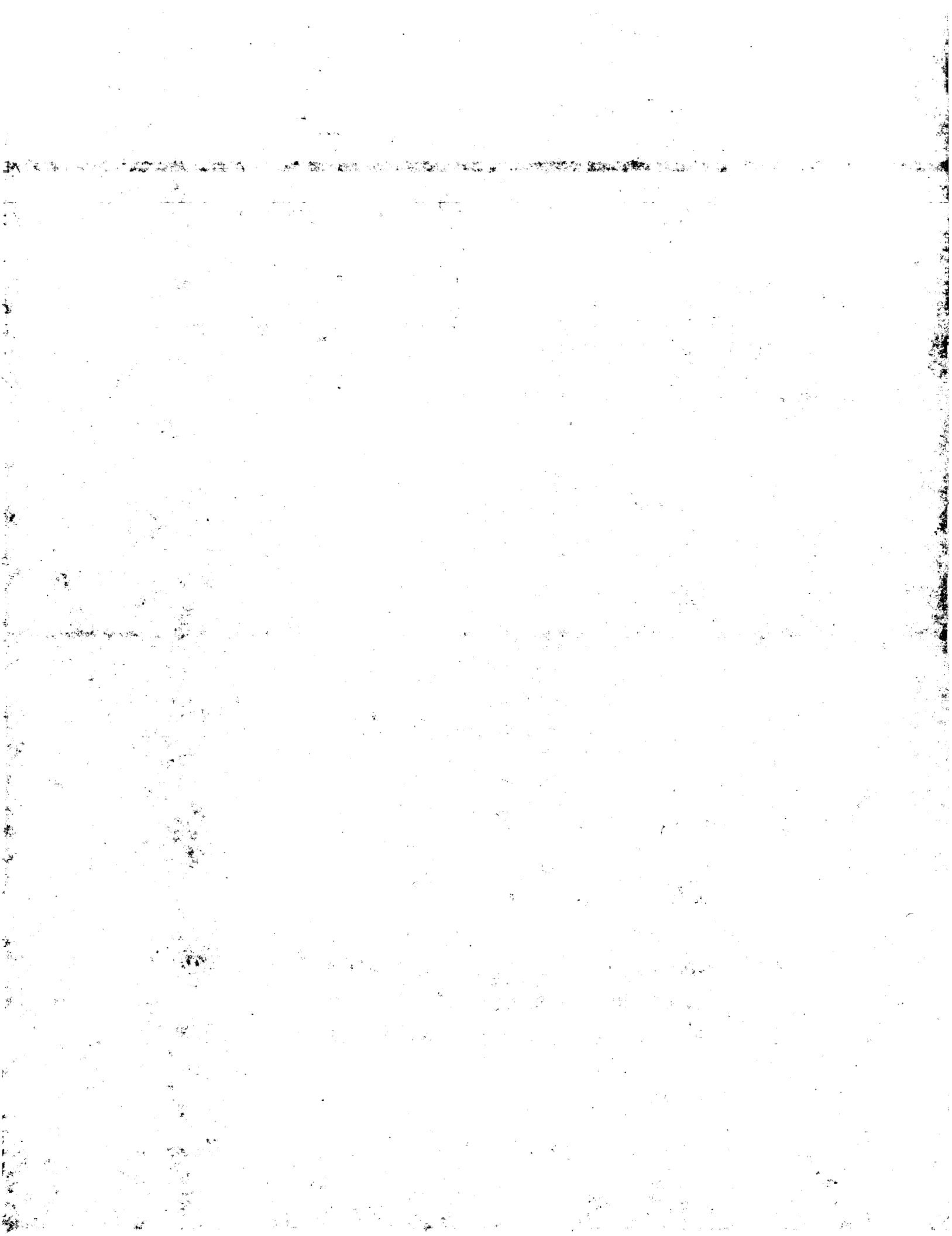
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(54) Title: METHOD AND APPARATUS FOR BACKLIGHTING A DISPLAY FOR DIFFERENT TIMES IN A BATTERY POWERED DEVICE			
(57) Abstract <p>A battery powered device (100) includes a battery (170) for powering the battery powered device (100) and a display (130) for presenting messages. The battery powered device (100) includes a light source (150) for illuminating the display (130) and a determiner (165) coupled to the light source (150) for determining whether the message is of a first type or a second type. A controller (120) drives the display (130) with a message and activates the light source (150) for a first time when the message is of the first type and for a second time, greater than the first time, when the message is of the second type.</p>			
<pre> graph LR R105[RECEIVER 105] --> D115[DECODER 115] D115 --> C120[CONTROLLER 120] C120 --> D130[DISPLAY 130] C120 --> L150[LIGHT SOURCE 150] C120 --> M180[MEMORY 180] L150 --> D130 L150 --> D165[DETERMINER 165] L150 --> C135[CONTROLS 135] L150 --> C140[CLOCK 140] L150 --> R145[RAM 145] L150 --> B170[BATTERY 170] L155[LIGHT SENSOR 155] --> C120 B170 --> C120 C120 --> M180 M180 --> D130 M180 --> D165 M180 --> C135 M180 --> C140 M180 --> R145 M180 --> B170 subgraph M180 [MEMORY 180] direction TB S1[SENSOR VALUE] <--> N1[NUMBER OF CHARACTERS FOR SCREEN] D1[DETERMINER] <--> ET[EXTENDED TIME VALUE] D1 <--> IT[INTERMEDIATE TIME VALUE] D1 <--> DT[DECREASED TIME VALUE] end </pre>			

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METHOD AND APPARATUS FOR BACKLIGHTING A DISPLAY FOR DIFFERENT TIMES IN A BATTERY POWERED DEVICE

Field of the Invention

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This invention relates in general to battery powered devices for displaying information, and more specifically to the variation of backlighting times in such devices.

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Background of the Invention

In conventional portable communication devices, such as paging receivers, messages are received and displayed to a user. A message is generally presented on the display for a fixed, predetermined amount of time, e.g., twenty seconds. The amount of current required for displaying the message is usually insignificant when compared to the current required for operating the communication device. Therefore, message presentation only insignificantly effects the life of a battery utilized to power the communication device.

20

Some portable devices also provide for illumination of the display during message presentation so that the user can read the message even in low light levels. Typically, the display is illuminated by an incandescent bulb or by an electroluminescent panel, both of which require relatively high currents for activation. Additionally, when illumination occurs, conventional devices illuminate the display for the same fixed, predetermined time period during which the message is presented. As a result, illumination significantly drains the battery and reduces battery life. In a smaller device, such as a pager, the battery is often small and usually has a relatively low capacity. Therefore, the battery is depleted quickly and must be replaced often. Further decreasing the battery life by illuminating the display for long periods is very undesirable.

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Thus, what is needed is a method and apparatus for illuminating message displays when necessary without significantly reducing battery life.

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Brief Description of the Drawings

FIG. 1 is an electrical block diagram of a battery powered device for displaying information in accordance with the present invention.

5 FIG. 2 is a flowchart depicting the operation of a controller included in the battery powered device of FIG. 1 in accordance with the present invention.

10 FIG. 3 is a flowchart illustrating the operation of a determiner included in the battery powered device of FIG. 1 in accordance with the present invention.

Description of a Preferred Embodiment

15 FIG. 1 is an electrical block diagram of a battery powered device 100, such as a portable pager or two-way radio, which includes circuitry for providing a controller 120 with a message or other information to be presented on a display 130. When the device 100 comprises a pager or other receiving device, the circuitry can include an antenna 105 for receiving signals, a receiver 110 for demodulating the signals, and a 20 decoder 115 for recovering messages from the signals. Additionally, an alert mechanism 125 is preferably coupled to the controller 120 for generating an alert, such as a vibration or audible alert, in response to message reception.

25 The device 100 also includes a battery 170 coupled to the controller 120 for powering the device 100, a clock 140 for generating time information, a display 130 for displaying messages, and controls 140 by which a user provides information to the controller 120. According to the present invention, the device 100 further comprises a light sensor 155, 30 such as a photodiode, for providing signals by which the controller 120 can determine a light intensity exterior to the device 100. For example, when the light sensor 155 comprises a photodiode, the controller 120 can determine the relative light intensity exterior to the device 100 by a voltage provided by the photodiode.

35 Further included in the device 100 is a random access memory (RAM) 145 for storing messages to be presented to the user and another memory 160 for storing a sensor value. The controller 120 determines in a conventional manner, such as by comparing the stored sensor value to the

signals from the light sensor 155, whether a light source 150 should be activated to illuminate a displayed message. The light source 150 can be, for example, an incandescent bulb or an electroluminescent panel located adjacent to the display 130. It will be appreciated that other types of light sources can be alternatively used and that any conventional method can be employed to determine whether the display 130 should be illuminated during message presentation.

According to the present invention, the memory 160 further stores a number of characters that can be presented on the display 130 at one time, 10 i.e., a number of characters that can be presented on a single screen of the display 130. Additionally, different time values, e.g., an extended time value, an intermediate time value, and a decreased time value, are stored in the memory 160 for use by the controller 120 in activating the light source 150 and in presenting a message.

15 A determiner 165 is included in the battery powered device 100 for determining message content, such as whether the message includes any numbers. The determiner 165 preferably provides to the controller 120 a time value indicative of a time during which the light source 150 should be activated. The determiner 165 can be, for instance, a firmware element 20 stored in the memory 160. Alternatively, the determiner 165 could be hardware capable of performing equivalent operations.

Typically, message presentation requires a relatively low current, e.g., two millamps. Illumination of the display 130, conversely, usually requires a relatively high current on the order of one-hundred millamps. 25 Therefore, in a battery powered device 100, illumination of a presented message will deplete the battery 170 much more rapidly than presentation without illumination. According to the present invention, the battery powered device 100 varies the time during which the message is displayed based upon whether the message is to be illuminated and based upon the 30 message content in order to reduce current and extend battery life. By way of example, when the light sensor 155 indicates that the exterior light intensity exterior is relatively high, the message can be displayed for an extended time without activation of the light source 150. When, on the other hand, the display 130 should be illuminated, the message can be 35 displayed, with illumination, during a shorter time than normal.

In conventional message presentation devices, such as paging receivers, a message is presented on a display for a predetermined time.

When the exterior light intensity is low, the conventional devices additionally activate a light source for the same predetermined time during which the message is displayed. This predetermined time is fixed and does not vary regardless of message content.

- 5 The battery powered device 100 according to the present invention advantageously varies the presentation and illumination times based on message content and based on the need for illumination. When, for instance, no illumination is necessary, the message is preferably presented for an extended period of time since message presentation requires
- 10 relatively little current. Preferably, when illumination is necessary and the message includes numeric characters, presentation and illumination occur for a shorter time, e.g., an "intermediate" time, so that current drain is reduced. When illumination is necessary and the message includes only non-numeric, such as alphabetical, characters, the message is presented
- 15 and illuminated for an even shorter time, e.g., a "decreased" time. In this manner, when a text message including no numbers is received, it is displayed and illuminated for a relatively short period of time because a person can usually read a message fairly rapidly. However, when the message includes numbers, such as in a telephone number, the message is
- 20 displayed and illuminated for a greater amount of time such that the user can read the message while dialing the telephone number. When no illumination is necessary, the message is presented for an even greater amount of time. As a result, battery life of a battery 170 powering the battery powered device 100, which varies illumination time, is extended
- 25 from that available in a conventional device which illuminates all messages for a fixed, predetermined time.

Referring next to FIG. 2, a flowchart illustrates an operation of the controller 120 included in the battery powered device 100. According to the present invention, the controller 120, at steps 200, 205, receives and stores a message and activates the alert mechanism 125 to announce reception of the message. When, at step 210, the controller 120 receives a display command from the controls 135, the controller 120 further determines in a conventional manner whether the display 130 should be illuminated during message presentation, at step 215. When the display 130 is not to be illuminated, e.g., when the exterior light intensity is relatively high, the controller 120 retrieves, at step 220, a first time value, e.g., an "extended" time value indicative of an extended time period, for use as a display time.

Thereafter, at step 225, the controller 120 drives the display 130 with the message for the extended display time. In this manner, the message can be displayed for an extended time without significantly draining the battery 170 because illumination is unnecessary.

5 When, at step 215, the display 130 is to be illuminated, the controller 120 provides, at step 230, the message to the determiner 165 (FIG. 1). In response, the controller 120 receives, at step 235, a time value from the determiner 165. This time value, which is preferably indicative of a shorter time than when illumination is unnecessary, is used as the display 10 time by the controller 120. In other words, the controller 120, at step 240, drives the display 130 and activates the light source 150 for the reduced display time provided by the determiner 165.

FIG. 3 is a flowchart illustrating the operation of the determiner 165. According to the present invention, the determiner 165 receives, at step 15 300, a message from the controller 120. When, at step 305, the message does not include any numeric characters, the determiner 165 preferably provides, at step 320, a "decreased" time value to the controller 120. According to the present invention, the decreased time value indicates to the controller 120 that the message is to be displayed and the light source 20 150 is to be activated for a relatively short time in comparison to the extended display time used when no illumination is necessary. Therefore, less current is required than would be the case if illumination was provided during the relatively long "extended" time.

When, at step 305, numeric characters are included in the message, 25 indicating the possible presence of a telephone number, the determiner 165 further determines, at step 310, whether the entire message can be displayed on a single screen of the display 130, i.e., whether the entire message can be displayed at one time. When the message can be displayed on a single screen, an "intermediate" time is preferably provided, at step 30 325, to the controller 120. This intermediate time is a compromise between the decreased time in which messages are displayed and illuminated fairly quickly to avoid significant current drain and the extended time in which messages are presented without illumination. The intermediate time is employed so that the user has a sufficient amount of time to dial a 35 telephone number included in the illuminated message.

When, at step 310, the entire message cannot be displayed on a single screen, the message is generally scrolled so that successive screens of

message information are displayed sequentially. In this case, the determiner 165 further determines, at step 315, whether the last screen of characters that will be presented includes any numeric characters. When the last screen of characters includes numbers, indicating the possible 5 presence of a telephone number, the intermediate time is preferably provided, at step 325, to the controller 120. When no numbers are included in the last screen, the decreased time is preferably provided, at step 320, to the controller 120.

By way of example, the extended time value, used when 10 illumination is unnecessary, could be set to twenty seconds because the mere presentation of the message, even during an extended time, only insignificantly affects battery life. The intermediate time value, used when an alphanumeric or numeric message is to be illuminated, could be set to ten seconds to reduce the current drain resulting from illumination while 15 providing the user adequate time to read the message and dial a telephone number. The decreased time value, used when a non-numeric message is to be illuminated, could, for instance, be set to five seconds since the user is not required to dial a telephone number while reading the message.

It will be understood, however, that the time values indicative of 20 illumination and presentation times could be additionally varied according to the battery capacity so that, for high capacity batteries, illumination occurs for a longer time, while, for low capacity batteries, illumination occurs for a shorter time. Additionally, the time values could be varied based upon different types of messages and message 25 content. For example, when the battery has a particularly low capacity, illumination and display could be performed for a very short time for most messages and for a marginally longer time for messages determined to include an entire seven-digit telephone number.

Furthermore, it may be desirable to vary the time values according 30 to how the message is processed. For instance, many portable battery powered devices can now be coupled to other devices, such as printers or personal computers, for downloading messages thereto. In such a case, when the battery powered device was coupled to an external presentation device, a message could be presented, if desired, without any illumination 35 even when external light levels are low. The user could then read the message on the external device when downloaded. When, conversely, the battery powered device was detached from the external device, the

illumination and presentation times could be programmed to avoid significant depletion of a battery powering the device.

It will be appreciated by now that there has been provided a method and apparatus for extending battery life in a battery powered device by 5 varying the amount of time during which a displayed message is illuminated based on message content. In other words, messages of a first type, e.g., messages including numbers, are illuminated and presented for a greater period of time than are messages of a second type, e.g., messages having no numbers.

CLAIMS

1. A method for varying backlighting times in a battery powered device having a display for presenting a message and a light source for illuminating the display, the method comprising the steps of:
 - 5 determining whether the message is of a first type or a second type;
 - driving the display with the message and activating the light source for a first time when the message is of the first type; and
 - 10 driving the display with the message and activating the light source for a second time, greater than the first time, when the message is of the second type.
2. The method of claim 1, wherein the battery powered device
15 comprises a paging receiver for receiving and presenting the message, and wherein the determining step comprises the step of:
 - determining whether the message is an alphanumeric message or a non-numeric message.
- 20 3. The method of claim 1, further comprising the steps of:
 - deciding, prior to the determining step, whether the message is to be illuminated during presentation, wherein the driving and activating steps occur in response to deciding that the message is to be illuminated; and
 - 25 presenting, subsequent to the deciding step, the message without activating the light source for a third time in response to deciding that the message is not to be illuminated, wherein the third time is greater than the first and second times.
- 30 4. The method of claim 3, wherein the first type of message includes messages that have no numeric characters and the second type of message includes messages that have at least one numeric character, and wherein the determining step comprises the step of:
 - determining whether the message includes at least one numeric character.

5. The method of claim 3, wherein the deciding step comprises the steps of:

 determining a relative light intensity exterior to the battery powered device; and

5 deciding whether the relative light intensity is low enough to require illumination of the message.

6. The method of claim 5, wherein the light source is an electroluminescent panel situated adjacent to the display, and wherein the
10 activating steps comprise the step of providing power to the electroluminescent panel.

7. The method of claim 5, wherein the light source is an incandescent bulb, and wherein the activating steps comprise the step of
15 providing power to the incandescent bulb.

8. A battery powered device including a battery for powering the battery powered device and a display for presenting messages, the battery powered device comprising:

20 a light source for illuminating the display;
 a determiner coupled to the light source for determining whether the message is of a first type or a second type; and
 a controller coupled to the light source and the display for driving the display with a message and activating the light source for a first
25 time when the message is of the first type and for a second time, greater than the first time, when the message is of the second type.

9. The battery powered device of claim 8, wherein the battery powered device comprises a paging receiver including:

30 an antenna for receiving a signal;
 a receiver coupled to the antenna for demodulating the signal;
 and
 a decoder coupled to the receiver and the controller for recovering the message from the signal.

35 10. The battery powered device of claim 8, further comprising a memory for storing the message.

11. The battery powered device of claim 8, wherein the light source comprises an electroluminescent panel.
12. The battery powered device of claim 8, wherein the light source 5 comprises an incandescent bulb.
13. The battery powered device of claim 8, wherein the first type of message includes messages that have no numeric characters, and wherein the second type of message includes messages that have at least one 10 numeric character.
14. The battery powered device of claim 8, further comprising a light sensor for determining a relative light intensity exterior to the battery powered device, wherein the controller drives the display with the 15 message without activating the light source for a third time when the relative light intensity is high enough that illumination of the message is not necessary, wherein the third time is greater than the first and second times.
- 20 15. The battery powered device of claim 14, wherein the light sensor includes a photodiode.
16. A paging receiver including a battery for powering the paging receiver and a display for presenting messages, the paging receiver 25 comprising:
 - receiving means for receiving a message;
 - a memory for storing the message;
 - a light source for illuminating the display;
 - a determiner coupled to the light source for determining 30 whether the message is of a first type or a second type; and
 - a controller coupled to the light source and the display for driving the display with the message and activating the light source for a first time when the message is of the first type and for a second time, greater than the first time, when the message is of the second type.
- 35 17. The paging receiver of claim 16, further comprising an alert mechanism for announcing reception of the message.

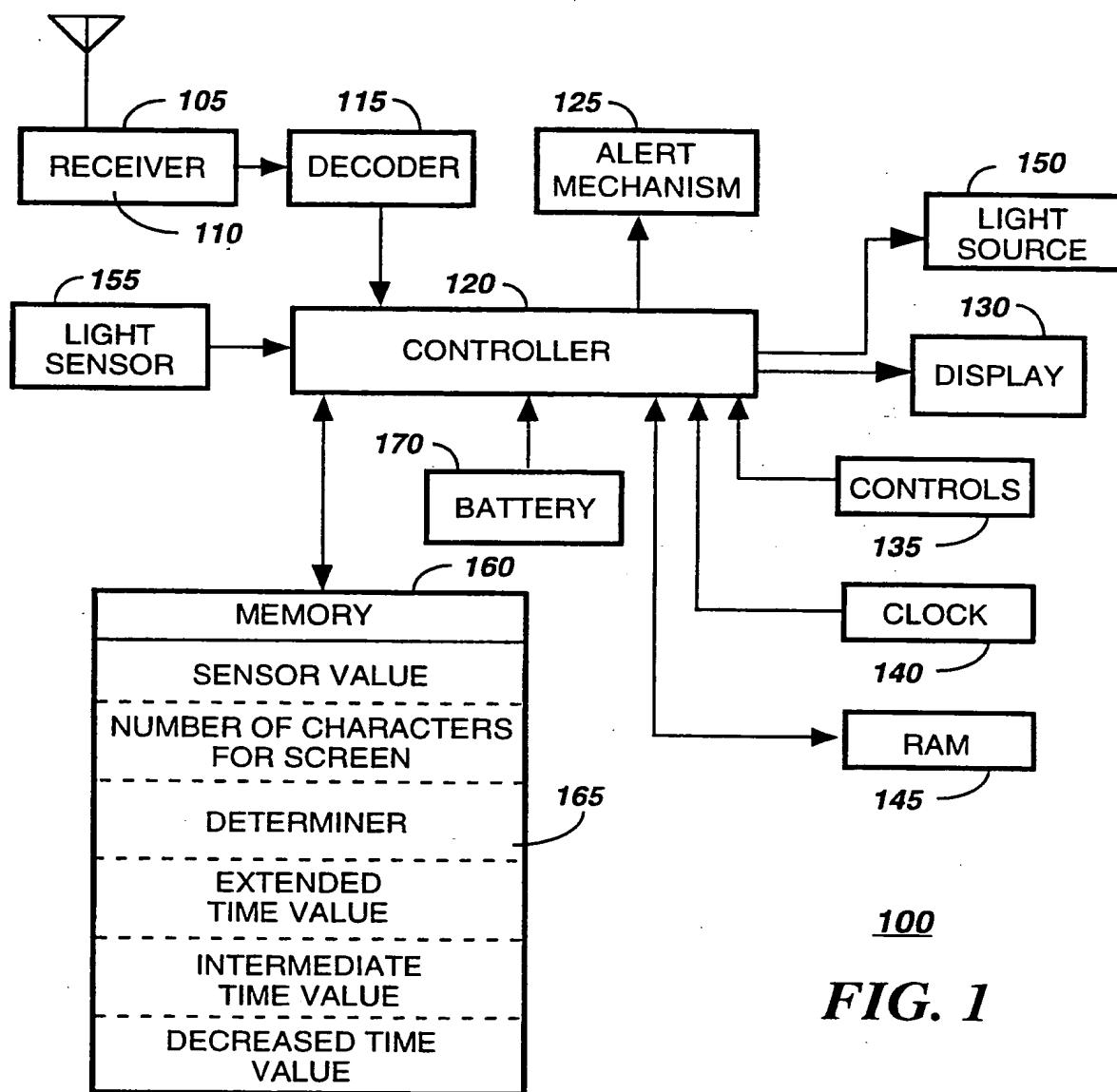
18. The paging receiver of claim 16, wherein the light source comprises an electroluminescent panel.

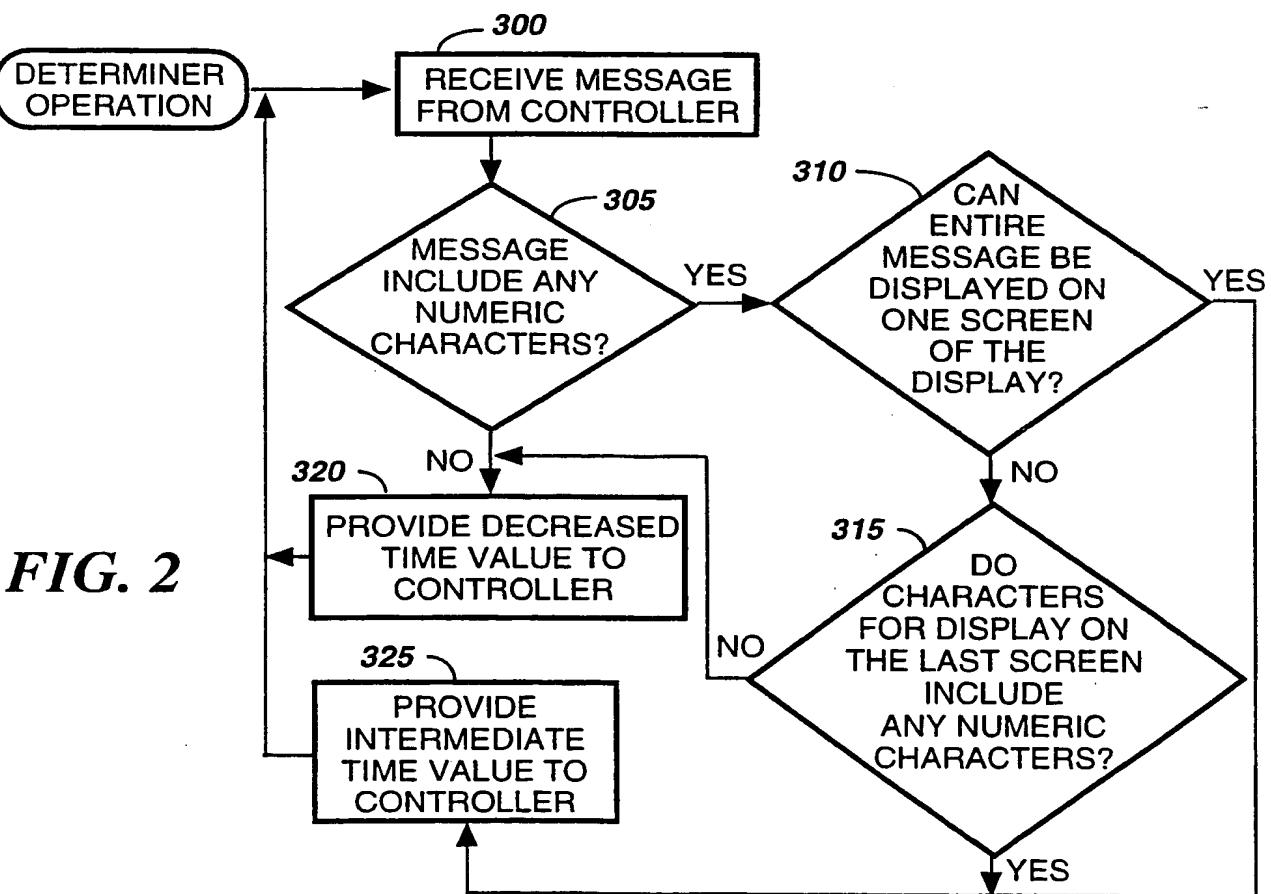
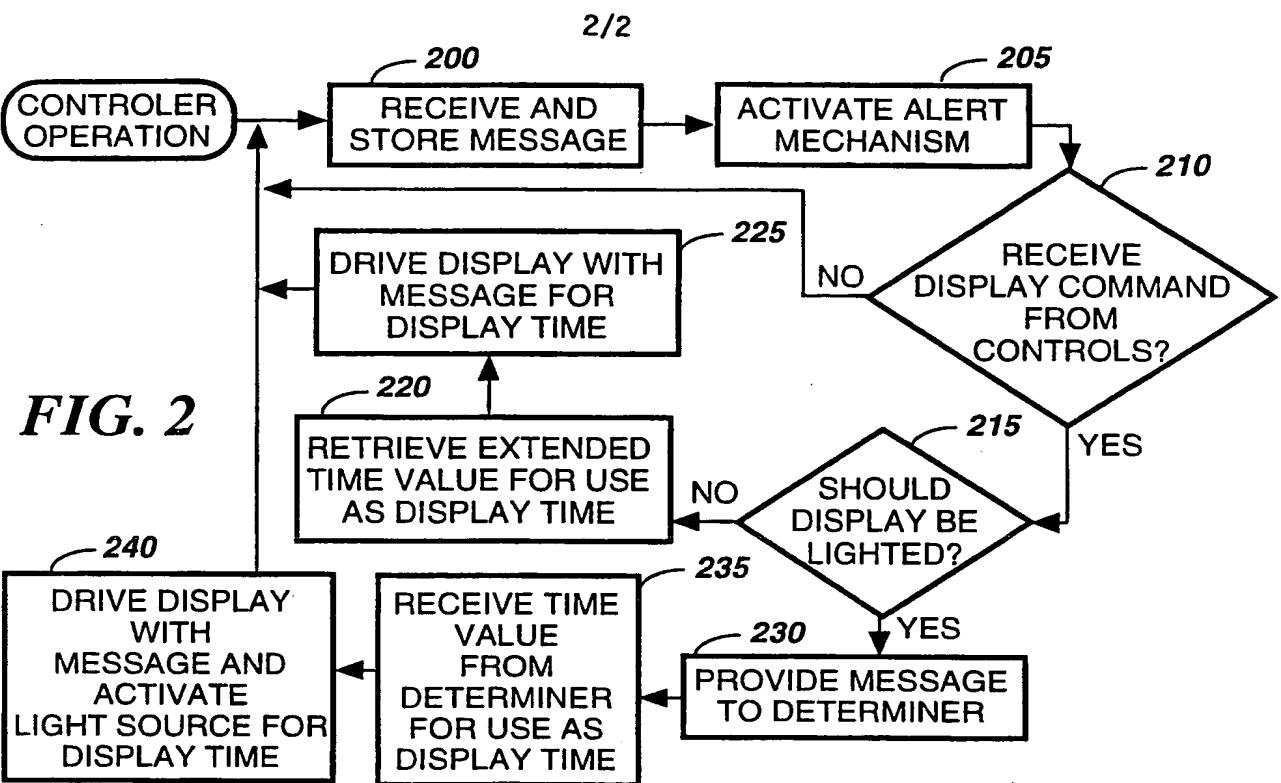
19. The paging receiver of claim 16, wherein the light source 5 comprises an incandescent bulb.

20. The paging receiver of claim 16, wherein the first type of message includes messages that have no numeric characters, and wherein the second type of message includes messages that have at least one 10 numeric character.

21. The paging receiver of claim 16, further comprising a light sensor for determining a relative light intensity exterior to the paging receiver, wherein the controller drives the display with the message 15 without activating the light source for a third time when the relative light intensity is high enough that illumination of the message is not necessary, wherein the third time is greater than the first and second times.

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100**FIG. 1**



INTERNATIONAL SEARCH REPORT

International application No.

PCT/US96/10767

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :G09G 3/36

US CL :345/102

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 345/102, 87, 148; 340/825.44

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US, 5,323,148 (OLAZABAL ET AL) 21 June 1994, col. 2, lines 17-42.	1-21
Y	GB, 2,261,983 (Beesley) 02 June 1993, page 2, line 33 - page 3 line 9.	1-21
Y	EP, 168,821 (OYAGI ET AL) 22 January 1986, abstract.	3-7, 14-15, 21

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